



UConn Botanical Conservatory

STRATEGIC PLAN

2022-2027



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This strategic plan for the UConn Botanical Conservatory was developed by Dr. Cynthia Jones, Director of the UBC, its staff (Meghan Moriarty, Dr. Matthew Opel, Amanda Garchow) and Advisory Committee (Dr. Bernard Goffinet, Dr. Jeff Seemann and Dr. Yaowu Yuan). Image: *Stenocactus crispatus*

EXECUTIVE SUMMARY

With the largest and most diverse collection of plants at an academic institution in the Northeast, and one of the top three most diverse university greenhouse facilities in the country, the UConn Botanical Conservatory (UBC) in the Department of Ecology and Evolution at the University of Connecticut (<http://florawww.eeb.uconn.edu/>) provides outstanding research facilities and profound, immersive learning opportunities for students and residents of the state of Connecticut and beyond.

Through supporting cutting-edge research on plant responses to climate change, gene-expression and ecological interactions, for example, and by providing a portal into living biodiversity, the Botanical Conservatory ignites awe, appreciation, and ultimately understanding of the critical message that the future of humans is intimately tied to the health of plants, both wild and cultivated. Providing experimental, multisensorial and hands-on engagement with plants propels UConn to the forefront of academic institutions discovering and sharing knowledge that fosters an understanding the earth and its biological future.

With over 2700 species representing nearly 1% of the earth's plant biodiversity in about 10,000 SF, the Conservatory Collection is a living library of extraordinary scientific, conservation, and educational value, unequalled among peer institutions. Approximately 3,000 students per year complete course assignments in the Conservatory or using plant materials provided by the Conservatory. Hundreds of off-campus visitors, both as informal browsers and in organized tour groups, experience the sights, smells, and feel of this unique collection. Unusually robust documentation of the Conservatory Collection that is accessible to the world via the website, as well as our policy of sharing material for research and educational purposes, support a global community of plant biologists.

In a separate, nearby rooftop facility that is not open to the public, researchers spanning the range of scholars from faculty to undergraduates associated with multiple departments grow plants to discover fundamental tenets of basic plant biology, ranging from genetic mechanisms underlying developmental diversification to the maintenance of rare breeding systems in endangered species. Much of the work is or has been funded externally by federal agencies and has resulted in numerous publications and presentations.

Supporting research and maintaining an extraordinary Conservatory Collection in a 60 year-old greenhouse are not without their challenges. Our strategic planning process has identified strengths, weaknesses, opportunities and threats that we will address through five major goals that will build on what the UBC already does well:

- Facilitate continued growth of cutting-edge research in the UBC, emphasizing research that is externally funded.
- Establish the UBC as a central pillar of coursework-associated experiential learning in EEB and the University.
- Significantly expand the role of the UBC as a critical scientific and educational resource for the University, local community, and state.
- Increase the scientific value of the Conservatory Collection for research, education and engagement.
- Create a comprehensive plan for replacement of the current TLS greenhouses and preservation of the living biodiversity collection.



MISSION

The UConn Botanical Conservatory **provides statecture** for studies of ecology, evolution, biodiversity and climate change; **inspires and supports innovative, immersive educational opportunities** for formal and informal exploration of plant biodiversity; **heightens community understanding** and engagement of important scientific and social issues and **protects and stewards** a remarkably diverse collection of living plants.



VISION

The UConn Botanical Conservatory is the foundational infrastructure for plant biology and botanical research, education, and conservation of living plant material that **facilitates** state of the art research in plant evolution, climate change, biodiversity, conservation and genomics among many other topics; **fosters** appreciation and understanding of the critical role of plants in a rapidly changing world through novel, active and multisensory learning experiences; **immerses** the UConn community and the people of the state of Connecticut in living biodiversity; and **conserves** endangered species.



Note greenhouses next to the Budds Building, circa 1924.

ORGANIZATION

1. DESCRIPTION OF THE UCONN BOTANICAL CONSERVATORY

Since the early days of the Storrs Agricultural College, greenhouses have been integral to the research, educational, and outreach missions of the University. A pillar of the science curriculum since UConn's founding in 1881, botany became its own department in 1925 and for 50 years remained as such until incorporated into the Biological Sciences Group. In the late 1950s, a new state-of-the-art science building (Torrey Life Sciences, TLS) was built to house the departments of botany, genetics and zoology. Overseen by the Chair of the Department of Botany, Wendell Holmes Camp, construction of the new science building also included an attached greenhouse, now the TLS greenhouses, that supported research and teaching of the botany group. In the mid-1980s the Biological Sciences Group evolved into separate departments--Ecology and Evolutionary Biology (EEB), Molecular and Cell Biology (MCB) and Physiology and Neurobiology (PNB)-- and the greenhouses were placed under the jurisdiction of EEB.

The UBC is now foundational to botanical research, education, and outreach for the Department of Ecology and Evolutionary Biology and the University at large. The facility consists of two greenhouse complexes, one at ground level

and physically attached to TLS (10,961 SF growing space with a 2,476 SF headhouse) and one on the roof of the Biology Physics Building (BPB) (6,581 SF total). The BPB rooftop facility opened in 2004 as a state-of-the-art greenhouse designed for research; it is not open to the public. Each of the ten growth rooms are equipped with a computer-based climate control system (ARGUS, upgraded 2021) that allows customization of growing temperatures, day-lengths, and watering regimes. Activities in the BPB greenhouses are supported in part by a small adjacent rooftop headhouse (1,565 SF), with the bulk of headhouse needs accommodated by the nearby TLS headhouse. Nine of the ten rooms have both fixed and rolling benches that provide 312 SF of growth space per room. The other room provides space for aquatic tubs, tall plants, etc. About 15% of BPB space is allocated to collection materials that do not thrive in the TLS facility, as well as some teaching materials.

The Conservatory Collection in TLS is the most diverse of any collection at a public institution in the Northeast, and one of the three most diverse collections at an academic institution nationally. Nearly 6,000 individual plants representing 2,700+ species offer a living library of nearly 1% of global plant diversity from across the plant tree of life.



Google Earth image of the BPB Greenhouse complex on the rooftop of the Biology Physics Building and the TLS Greenhouse complex on the ground.

Phylogenetic diversity: Approximately 93% of the individual plants currently in the collection represent 236 families of angiosperms (flowering plants), i.e., 56% of the 416 recognized families. Gymnosperms are represented by 52 species in 11 families (of 12 currently recognized). Ferns and fern allies (the monilophytes and lycophytes) are represented by 138 species in 22 families (of 51 currently recognized). The bryophytes, i.e., the non-vascular plants, are represented by a few species in established cultures (of 175 currently recognized). This discrepancy is due to the difficulty of growing many bryophyte species in greenhouse conditions.

Geographic diversity: Holdings in the collection come from all continents except Antarctica. Maps showing geographic distributions of each species are available at the UBC website <http://florawww.eeb.uconn.edu/>. In terms of biomes, about 48% of plant accessions are from the tropical regions of Asia, Africa and the Americas; 26% are from the Eastern and Western Hemisphere deserts; 13% are from the six Mediterranean-climate regions of the world; and 13% are from the temperate regions of the Southern and Northern Hemispheres.

Scientific value and conservation status: Nearly 500 species in the Conservatory Collection have been collected from the wild, thus of “known provenance,” which greatly increases their scientific value. The collection currently contains seven species considered extinct in the wild, 35 listed as critically endangered, and 55 as endangered. We track the conservation status of species in our collection and comply with all national and international regulations regarding exchange of living plant materials. The genetic diversity of these plants is a global asset, and we have a great responsibility to keep their genotypes viable through propagation, seed collection, and careful cultivation.



Colocasia gigantea

Notable Collections: The Conservatory Collection also contains several notable collections of specific plant groups. The facility now houses nearly 150 species of tropical gingers and their relatives that were obtained from the Kress Collection at the Smithsonian Institution with the support of Dr. John Kress. Some of these plants are “new to science,” meaning that their discovery is so recent they have yet to receive a formal scientific name, and many are rare.

The Conservatory also houses one of the more diverse collections of carnivorous plants in the Northeast. Perhaps the most remarkable and unique collection is of *Conophytum*, a genus of “living stones” from South Africa. Due to the efforts of Collections Manager Dr. Matt Opel, a recognized expert on the group, UConn is home to more species of *Conophytum* than just about anywhere else in the world.



The UBC hosts a nearly complete collection of the 109 species of *Conophytum*, a group of “living stones” from the deserts of southern Africa. *Conophytum bachelorum* is one of 14 *Conophytum* taxa that are critically endangered or extinct in the wild, which are successfully grown and propagated at the UBC. Many wild populations of *Conophytum* are in steep decline because of rampant poaching and unprecedented drought; long-term greenhouse collections of well-documented and legally-acquired plant material, like those at UConn, may be the only way some species avoid extinction.

A complete list of all species in the UBC is available at the website that is both the public face of the UBC as well as the primary management tool. Originally designed and constructed by Clinton Morse (retired former General Manager) the website lists every plant in the collection, its location, relevant scientific information for most species, relevance to humans, and CITI status and collection information. In addition, the website lists notable collections by type, as well as geographic regions. The greenhouse staff also uses the website to track the cultivation practice for each plant. This website is an incredible asset and elevates the value of the collections for daily users as well as virtual visitors from around the world.

Adjacent to the TLS facility is a fenced outdoor garden of 10,000 SF with public access that is used for displays, teaching, and additional growing space during the summer growing season. This garden includes a stand of rare beach plums originally collected from Cape Cod, a pollinator garden, various vegetables, and an “edible forest”. It has also supported research projects over the years, including a current project on honey bees.

The UBC is staffed by three full time employees: a General Manager, a Collections Manager and a Horticulturist. All UBC staff respond to emergencies as needed. The General Manager supervises all staff and oversees all aspects of the physical facilities, ordering, staff schedules, scheduling of tours, etc. The Collections Manager curates the collection, exchanges material with other institutions, keeps records, and is responsible for compliance with state and federal regulations as well as horticultural duties spread across both greenhouses. The Horticulturist conducts daily maintenance and upkeep of most of the conservatory collection. All staff participate in planting and maintaining the seasonal outdoor gardens. In addition, one or two part-time student workers provide critical additional support while an organized group of trained student volunteers help when possible.



EEB PhD student Kerri Mocko studying seedling responses to drought.

2. ACADEMIC, SCHOLARLY AND OUTREACH ROLES

Research: Approximately 35% of the total UBC space is devoted to supporting research. While most occurs in the BPB facility, the TLS facility also houses some research materials. The BPB facility provides growth rooms with individualized computer-assisted climate control required for research of faculty, staff and students in EEB, as well as MCB, and occasionally other departments. Furthermore, this essential infrastructure and associated collection helps to attract top-flight faculty, post-doctoral fellows and graduate students interested in cutting-edge research addressing critical questions in botany, biodiversity, and climate change.

The UBC staff share cultivation responsibilities for the BPB facility, with the bulk of daily maintenance falling to the Collections Manager. The primary roles of staff are to provide sanitation, safety and user training; manage pest outbreaks; keep supplies stocked; respond to researcher requests for cultivation advice and assist with plant cultivation as needed.

Local Formal Education: The UBC provides an essential immersive educational environment for formal academic programs on multiple levels. One of its central roles is to serve as a living laboratory of global plant and ecosystem biodiversity for students. Over 3000 students per year from BIOL 1102, BIOL 1108, EEB 2244, and several other upper division EEB courses complete lab exercises that are conducted in the greenhouses as self-guided or instructor-guided exercises or exams. Also, during the semester, an additional 60–70 students from courses in other departments pass through the greenhouses at least once, including Plant Science, Archeology, and various Art departments. Over 800 plants per semester are grown specifically for destructive experimentation for BIOL 1102 and BIOL 1108 and depending on the semester, from 20–400 conservatory plants are brought to classrooms for non-destructive use. Specific courses that are heavily dependent on the Conservatory Collection are EEB 3203/5203 (Plant Developmental Morphology, ~400 plants), EEB 3220 (Evolution of Green Plants, 50 plants), EEB 3271 (Systematic Botany, 200-300 plants) and EEB 4276 (Plant Structural Diversity, ~100 plants).



Dr. Matt Opel, Collections Manager, giving a tour to a Boy Scout Troop.

Regional and Local Informal Education (Outreach): The Botanical Conservatory is open to the public Monday - Saturday and staff are happy to answer questions. In addition, UBC staff provide over 50 tours per year for UConn programs, e.g., Open-House weekend, Parent's weekend, and Alumni Events, as well as to groups from across Connecticut ranging from elementary classes to senior citizens, clubs of various types, and other regional programs. Some of these public tours are general, others are thematic, e.g., orchids, carnivorous plants, succulents, etc. The UBC staff also give numerous talks per year about the collections to various organizations, and garden and specialty clubs. The UBC also participates regularly in activities hosted by the Connecticut Science Museum and the Connecticut Flower and Garden Show.

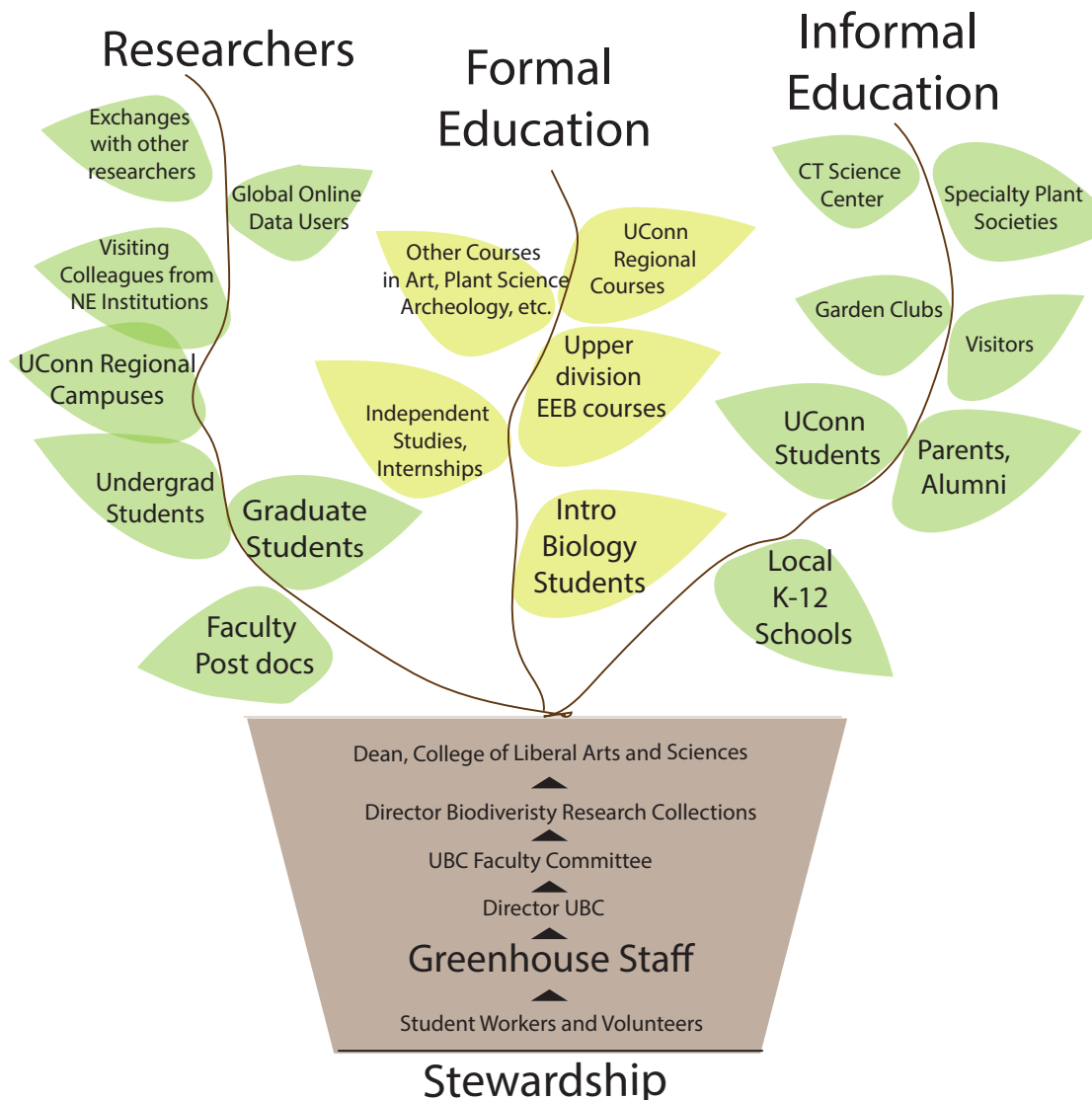
National and International Academic Role: Each year, the UBC receives requests for plant materials from researchers and educators from 50–100 institutions external to UConn. These requests provide crucial material for scientific studies such as phylogenetic diversity, genetic and genomic diversity, conservation biology, and evolution of functional traits, to name a few recent requests. The collections manager responds to these requests following protocols aligned with national and international regulations. In 2021, requests were filled for over 225 plant specimens. We also regularly accept material, preferably of known provenance, from other institutions. As a result of increasing documentation and diversity, the scientific value of the Conservatory Collection has grown dramatically over the last two decades and is now internationally recognized. In addition, the UBC is visited several times per year by academic researchers from other institutions. Via its website, support of visiting scholars, and fulfillment of requests for material from other institutions, the UBC supports a global community of plant biologists.

3 UNIVERSITY POSITION

The UBC is a division of the Biodiversity Research Collections of the Department of Ecology and Evolutionary Biology in the College of Liberal Arts and Sciences at the University of Connecticut and is located on the UConn Storrs campus. The UBC facility comprises two glass house complexes and two supporting headhouses that total 20,018 SF. In addition, the facility includes 10,700 of outdoor growing space.

4 STAKEHOLDERS

The UBC is supported by the College of Liberal Arts and Science (CLAS) and administered by the Department of Ecology and Evolutionary Biology, which provides stewards ranging from the Department Head to student workers and volunteers. These facilities serve myriad researchers, ranging from UConn faculty, UConn graduate and undergraduate students, and faculty from nearby institutions. The UBC also serves both the formal educational mission of UConn at multiple levels to a large number of students, as well as provides immersive educational and inspirational opportunities for a range of stakeholders in local communities, including visitors from across the state.



Stakeholders, stewardship, and reporting structure (shown by arrows) of the UBC.

ENVIRONMENTAL ANALYSIS

Assessing strengths, weaknesses, opportunities, and threats provides a framework for identifying goals for the future that build on existing strengths while mitigating weaknesses.

1 STRENGTHS

- The most diverse, largest and well-documented collection at a public institution in the northeast and one of the top three in the country, with
 - broad representation of global vascular plant diversity
 - nationally reputed specialized collections of Gingers, carnivorous plant and “living stones” from South Africa
 - detailed documentation and reference information for every species
 - nearly 500 accessions of known provenance
 - regular exchange of plant material with other education insitutions for research and educational purposes:
 - supports a global community of plant biologists
 - enhances the scientific reputation of UConn
 - strengthens UConn infrastructure for education, outreach, and research
 - increases conservation value by increasing genetic diversity
- Modern research facilities with an ARGUS environmental control system (updated 2021)
- An extraordinary and dedicated staff with significant expertise who advise researchers and who maintain plants in the best possible condition
- Exceptional quality and breadth of educational materials supporting learning objectives in biodiversity, ecological adaptations, and evolutionary innovations
- Unique learning and training opportunities for students, student volunteers and student workers

2 WEAKNESSES

- Numerous structural and mechanical issues threaten the 60-year-old TLS facility:
 - cracked and broken ceiling glass panels
 - disintegrating caulk that holds the glass panels in place (and that contains asbestos)
 - old, rusted steam heating pipes
 - permeable cement walls that “weep” when it rains
 - outdated lights
- Lack of capacity for control of both temperature (i.e., cooling via heat exchangers) and atmospheric CO₂ concentration (for climate change studies) in the BPB facility
- No operational policies for collection acquisitions, space allocation for researchers, disaster plans, or user fees for researchers
- No funding for new educational or outreach initiatives.

3 OPPORTUNITIES

- Increase physical infrastructure (cooling, CO₂) in BPB to expand research capacity and stimulate more externally funded research
- Develop policies that enhance operational efficiency and safety in the BPB facility
- Develop a new conservatory facility that crystallizes UConn's commitment to promoting and preserving biodiversity while greatly enhancing formal and informal experiential education and dramatically improving growing conditions for plants
- Seek external funding for formal and informal education that could lead to the development of novel, exciting displays and other educational materials that could transform plant biodiversity and climate change awareness across campus and the state
- Develop formal courses and/or internships to create novel, experiential learning and "learning by leading" opportunities for students

4 THREATS

- Nearly all the threats to our current program stem from the age of the TLS greenhouses: lack of modern ventilation, heating, and shading systems leads to time-consuming, manually operated or jury-rigged solutions to climate control in the TLS greenhouses, lack of ability to fine-tune growing conditions, and constant problems with outages and repairs
- Daily working conditions present unpredictable safety issues: slipping glass panes occasionally fall into the facility; heating pipes occasionally burst
- Poor environmental control results in significant loss of plant material, e.g.
 - cold drafts due to cracks and gaps in the envelope are detrimental to tropical plants
 - lack of sufficient support structures precludes lighting necessary for growth of some species in the winter months
 - ceiling leakages cause rotting and fluctuating water temperatures
 - lack of sufficient supplemental lighting negatively impacts health and growth of plants in winter
- No back-up heating system: if University steam system fails in winter, 90% of the Conservatory collection will perish

GOALS and OBJECTIVES

In this time of rapid environmental change, the UBC is uniquely poised to connect people with plants in support of a thriving planet and to convey the critical message that the future of humans is intimately tied to the health of plants, both wild and cultivated. To advance research in understanding plant responses to climate change and the evolution of adaptations, our first strategic planning pillar focuses on **supporting growth of externally funded research** in the BPB facility by adding capacity for climate and CO₂ control that will inspire innovative climate change studies. Concomitantly, we will develop policies codifying researcher use of the facility and seek regular feedback from researchers. Our second pillar **encourages a more active role of the UBC in graduate and undergraduate education** by facilitating greater use of the Conservatory in existing courses as well as developing new courses and modules that attract large numbers of students from all parts of the University, including an active intern program. Recognizing that plants and nature enrich the lives of citizens of the University and surrounding towns, our third pillar **inspires novel informal botanical education and outreach strategies** through addition of high engagement educational signage, development of innovative activities, capitalization of the current interest in home-based horticulture, and increased student engagement based on fun. Our fourth pillar seeks to **elevate the scientific status of the Conservatory Collection** nationally and internationally. Finally, our fundamental challenge over the next five years is to **secure the future of our unique, irreplaceable Conservatory Collection** by working with administrators to design and build a new facility to house it.



I. SUPPORT RESEARCH AND RESEARCHERS

GOAL: Facilitate continued growth of cutting-edge research utilizing the UBC, emphasizing research that is supported by external funding sources.

1. The UBC committee in conjunction with Greenhouse staff will develop a statement of services and resources that researchers can expect from the UBC associated with a policy for user fees for the BPB facility.
2. The UBC committee will advocate for increased environmental control, e.g., heat exchangers and CO₂ regulation that would support a greater range of experimental environments for climate change research, plant development in response to environmental variation, etc.
3. The UBC committee will identify funding sources to promote initiation of faculty/student research that utilizes these facilities.
4. The UBC committee in conjunction with Greenhouse staff will develop policies for research space allocation in the BPB facility that prioritize externally funded projects while maintaining some space for those that are internally supported.
5. The UBC committee will work with the Greenhouse staff to increase the capacity of staff for support of faculty research, including periodic reassessment of researcher needs, increasing researcher support capacity in the BPB Headhouse, and facilitating acquisition and tracking of research materials.
6. The UBC committee in conjunction with Greenhouse staff will create standard operating procedures for users, including a guide to the new ARGUS system for researchers, a disaster plan for the research greenhouses, emergency procedures for alarm calls, and posters in the headhouse for training and safety.

2. ENHANCE UNDERGRADUATE AND GRADUATE STUDENT EDUCATION

GOAL: Establish the UBC as a central locus of experiential learning in EEB and the University.

1. Greenhouse staff and volunteers will work with instructors to create learning activities and displays centered on the unique living resources of the Conservatory to attract students from all academic areas of the University.
2. The UBC Director will design and implement a “Learning by Leading” internship program (e.g. <https://arboretum.ucdavis.edu/learning-by-leading>) that teaches plant care, environmental stewardship, and design of educational displays.
3. Greenhouse staff will work with instructors to reassess course needs for existing plants, their desired growth status (i.e., juvenile, vegetative, reproductive), and new acquisitions.
4. Greenhouse staff will improve and standardize production of on-time destructive use in teaching labs (ongoing).

3. INCREASE COMMUNITY ENGAGEMENT

GOAL: Significantly expand the role of the UBC as a critical scientific and education resource for the University, local community, and state.

1. The UBC Director will work with administrators to locate signage on North Eagleville and around the greenhouses and gardens to direct visitors to the greenhouses.
2. Graduate summer fellows provided by EEB will expand existing educational materials associated with individual plants and groupings of plants, including by biome and conservation status; expand the number of plants with QR codes that link to the website descriptions; and develop recordings for a self-guided tour.
3. The Collections Manager, volunteers, graduate summer fellows provided by EEB, and interns will create a variety of educational materials for informal education, including self-guided tours and rotating displays with specialized themes, including biodiversity, climate change, evolution, endangered species, etc.; these will be expanded to include social media.
4. The UBC Committee will research and implement a mechanism for tracking visitor numbers and receiving visitor feedback.
5. The UBC Director, the Greenhouse Staff and volunteers will raise funding for and develop the outside garden space as a welcoming destination with a welcome sign, seating, and a shade structure.
6. The Greenhouse General Manager will establish a greenhouse volunteer program that draws from the broader community.

4. ELEVATE THE SCIENTIFIC STATUS OF THE CONSERVATORY COLLECTION

GOAL: Increase the value of the collection for research, education and engagement.

1. The UBC committee, interested faculty and the Greenhouse staff will define strategic priorities for new acquisitions that will increase the scientific value of the Conservatory Collection for research by consulting EEB faculty to improve where Conservatory Collection is currently strong, e.g., land plant evolution, plant adaptation, pollination biology, as well as to identify and address collection weaknesses.
2. The UBC committee, interested faculty and the Greenhouse staff will identify strategic priorities for new acquisitions that will increase the value of the Conservatory Collection for education by consulting with instructors to identify shortcomings relative to their course content as well as continuing to add diversity in plant families underrepresented in our current collection.

3. The UBC committee, interested faculty and the Greenhouse staff will identify strategic priorities for new acquisitions that will increase the value of the Conservatory Collection for public outreach by adding representatives to popular collections such as carnivorous plants and orchids, by adding species with interesting stories or features, and by adding species with imperiled conservation status.

4. The Collections Manager will develop formal collection policies for (1) schedule 1 substance plants, (2) cultivation and replacement of CITES listed (Convention on International Trade in Endangered Species of Wild Fauna and Flora) and ESA (Endangered Species Act) holdings, and (3) loans and distributions, including a “Distribution Agreement” to accompany distributed plant material (no commercial use, citations in publications, etc.)

5. The Collections Manager will raise the status of the *Conophytum* collection by applying to become the National Collection Site for that genus.

6. The UBC Committee will encourage and support staff to participate in professional development opportunities.

5. LOOKING FORWARD TOWARD A NEW CONSERVATORY COLLECTION GREENHOUSE AND HEADHOUSE.

GOAL: Create a comprehensive plan for replacement of the current TLS greenhouses and preservation of the living biodiversity collection.

1. The UBC Director will continue to work with departmental and UConn leadership in building the case for this important University priority.

2. The UBC Director and General Manager will continue to work with University Planning Design and Construction to develop site recommendations, design parameters, and cost estimates.

3. The UBC committee will partner with the Dean of CLAS and UConn Foundation to raise external dollars to support the cost of the new conservatory.

Background image: *Nymphaea thermarum*, one of rarest plants in the Conservatory Collection. The species was known from a single location in Rwanda but has disappeared from there within the last ten years.

ASSESSMENT AND EVALUATION

At annual April meetings, the UBC Faculty Committee and greenhouse staff will review the prior year's progress on previously prioritized strategic objectives and then will identify strategic objectives to be addressed in the upcoming year. These strategic objectives will guide the establishment of the following year's goals required for the Annual Reports for individual staff (recognizing that feasibility of accomplishing these goals is subject to time available to staff once they have accomplished their daily duties of maintaining the current collection and support faculty in research and teaching). In September of each year, the UBC Faculty Committee and greenhouse staff will review progress to date on that year's objectives and realign expectations if necessary.





Nepenthes truncata



Amorphophallus titanum